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Black Pine-Leaf Scale

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The black pine-leaf scale (*Aspidiotus californicus* Coleman[3]) belongs to one of the sucking insect groups commonly called armored scales (Homoptera: Diaspididae: Aspidiotini), which are important pests of agricultural and ornamental plants. The most common insect associated with the black pine-leaf scale is the pine needle scale (*Phenacaspis pinifoliae* (Fitch)).

The black pine-leaf scale infests pine foliage—injuring by removing sap and, possibly, by injecting into the tree toxic enzymes secreted in the saliva. When the insects attack in great numbers they can severely weaken or kill the host tree.

Infestations of this insect are generally localized, sometimes in just a few trees. These localized infestations have been especially frequent in sugar pine and Monterey pine stands. Occasionally, however, epidemics ravage several thousand acres of forest, where every host tree may be infested. For example, large areas of Jeffrey and ponderosa pine in southern California have suffered recurring outbreaks since 1940. Ponderosa pine stands near Cashmere and Spokane, Wash., and Penticton, British Columbia, reportedly have been severely damaged by invasions of this insect (fig. 1).

Range and Hosts

The black pine-leaf scale is widely distributed in North America. It has been reported in all parts of the continental United States and Canada, and in the mountainous areas of Mexico (fig. 2). Its hosts include the following pine species: Mexican pinyon (*Pinus cembroides* Zucc.), lodgepole pine (*P. contorta* Dougl.), shortleaf pine (*P. echinata* Mill.), Jeffrey pine (*P. jeffreyi* Grev. & Balf.), sugar pine (*P. lambertiana* Dougl.), ponderosa pine (*P. ponderosa* Laws.), Monterey pine (*P. radiata* D. Don), pitch pine (*P. rigida* Mill.), and Digger pine (*P. sabiniana* Dougl.). It also attacks Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco).

Symptoms of Infestation

Black pine-leaf scale infestations are commonly associated with environmental conditions harmful to the hosts. Conditions include

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[3] Synonomy: *Aspidiotus pini* Comstock; (*Nuculaspis californica* (Coleman)).

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Figure 1.—Ponderosa pines partially defoliated by the black pine-leaf scale.

smelter fumes, smog, smoke, and dust from such sources as roads, trails, excavations, cement plants, and poultry yards. Around orchards, the repeated use of insecticides may be associated with outbreaks of the scale if the spray drifts are strong enough to harm the insects' natural enemies.

Viewed from a distance trees heavily infested with the black pine-leaf scale look like those dying from bark beetle attacks. Infested trees are most noticeable in the spring when discoloration of the affected needles becomes most pronounced and is not obscured by new foliage. By fall, affected needles drop off and leave the tree with sparse, short foliage. Radial and terminal growth is also reduced.

Before dropping off, the needles of heavily infested trees become yellowish and discolored. Where the scales have fed, they are often blotched by necrotic areas which impart a patchlike pattern to the needle coloration. If looked at close up, grayish-brown to black scale bodies, often tightly packed against each other, can be seen along the needle surfaces (fig. 3).

Biology and Habits

The insect passes through three major stages in its life cycle: Egg, nymph, and adult. The yellowish eggs are nearly microscopic in size and occur in masses held together by white wax filaments underneath the female scale, which is immotile. The eggs hatch within a few days, releasing appendaged, dark amber-colored nymphs or crawlers. The crawlers move

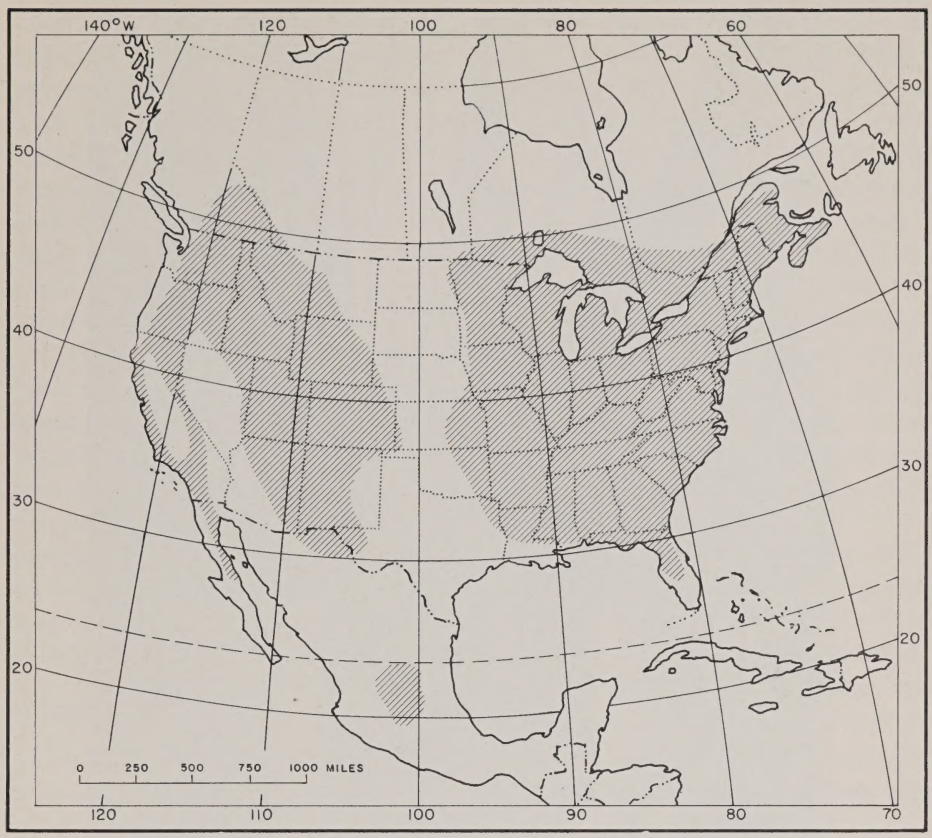

Figure 2.—Generalized distribution of the black pine-leaf scale.

about freely along the needles until they find a suitable spot to settle, usually along the angular surfaces of the young foliage. To feed, they insert their long filamentous beaks or stylets into the needles and suck the juices from the needle tissue.

At the first molt, the nymphs lose their appendages and become immotile. They then secrete over themselves a waxy covering that enlarges with subsequent molts to accommodate the growth and development of the insect.

The mature male and female scales are very similar in appearance, but the covering of the male is longer than that of the female (fig. 3). The female scales are 1 to 1.5 mm. in diameter. All scales are grayish black with lighter colored apical parts. The females are much more abundant than the males, the ratio being about 10 to 1. The adult male is very tiny and, unlike the female, is fully motile. He emerges from underneath the scale covering with legs, antennae, and wings fully developed, and can crawl about or fly.

The black pine-leaf scale has one to two generations each year, depending upon the climatic conditions in the area. In eastern Washington, toward the northern part of its range, the insect has only a single generation. Both

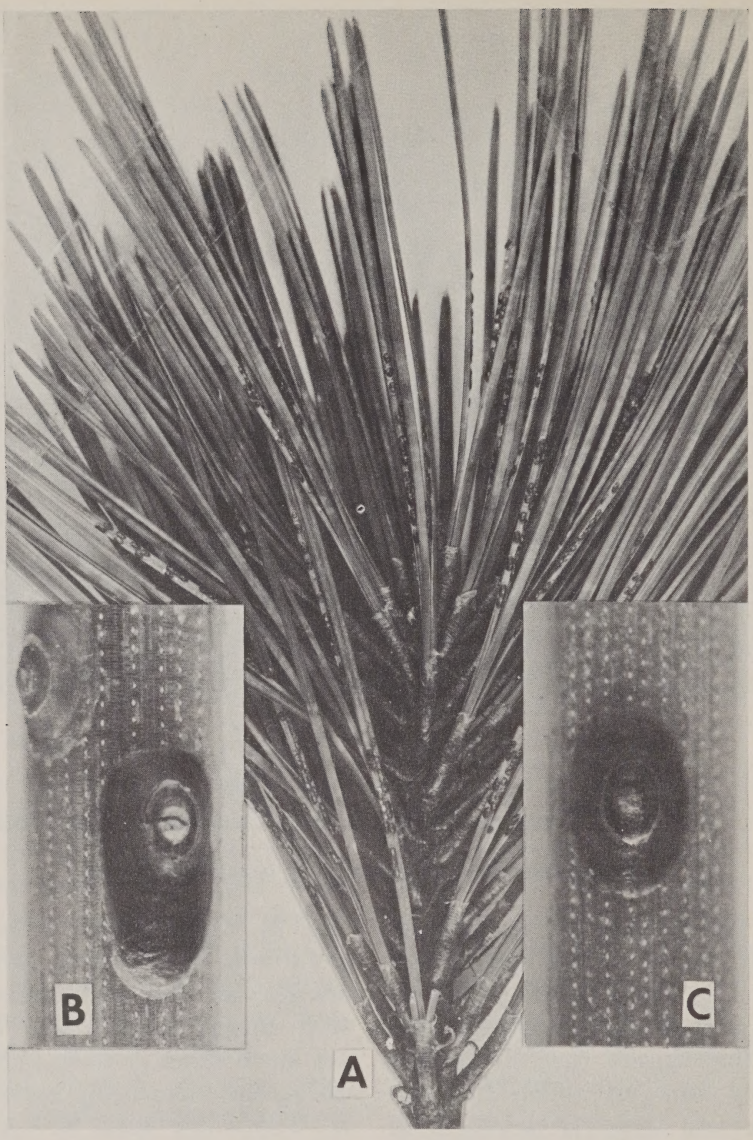

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Figure 3.—Black pine-leaf scales on ponderosa pine needles: A, Heavily infested foliage; B, scale covering male (enlarged); C, scale covering female (enlarged).

males and females mature during May. The males emerge between June 1 and 15, and mate with the immotile females. The females produce large numbers of eggs that hatch into crawlers between July 15 and August 7. Scale formation starts as soon as the crawlers settle, and the insects overwinter beneath this covering.

At the southern end of its range, the insect has two generations each year, and may have a partial third. In southern California, development is as follows: First generation—eggs, April to May 15;

crawlers, May 15 to June 15; scales, June 15 to July 15; second generation—eggs, July 15 to August 1; crawlers, August 1 to 15; scales, September 1 to October 15. The insects overwinter beneath the scales, but if warm weather prevails during fall and early winter, some may complete their development and start a new cycle.

Only in the crawler stage do both male and female insects move about freely. Most dispersion of populations takes place during this stage. Although the crawlers are able to migrate to some extent, many undoubtedly are transported to new hosts by air currents, birds, and possibly some of the larger flying insects.

Effect on Host Tree

Light populations of the black pine-leaf scale, up to 0.5 scale per inch of needle length, do not noticeably damage trees with normal healthy foliage. But heavy populations reduce the number, length, and retention period of the needles. Heavily infested ponderosa pines seldom retain more than 2 years' needle growth; normal retention is 3 to 5 years. When infestations reach 20 to 30 scales per inch of needle length, and remain at these high levels for several years, the tree produces fewer, shorter, and more yellowish needles each season (fig. 4) until it can produce no more.

Needle damage caused by scales is distinguished from that caused by chemically contaminated air or smog by the pattern of discoloration. Scale attacks cause the needles to become blotchy and necrotic. As the attacks progress, the needles turn yellow before they

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Figure 4.—Sparse, short needles on ponderosa pine suffering from persistent infestations of the black pine-leaf scale.

die. Needles affected by contaminated air discolor evenly, especially toward their tips, and give rise to a condition sometimes called tip burn.

Control

Natural enemies and climate are important in checking black pineleaf scale populations. In at least one case, heavy scale mortality resulted from desiccation of the foliage during an unseasonably cold (7° to 25° F.) March that followed a period of unusually warm weather, which had stimulated tree growth.

At least three species of parasites attack the scale: *Physcus howardi* Compere, *Prospaltella aurantii* (Howard), and *Aspidiotiphagus citrinus citrinus* (Craw.). Ladybird beetles also prey on it. The relative importance of these insects, however, is not known.

Infestations can be reduced below damaging levels by properly timed sprays. Malathion or guthion have been highly effective. In experimental studies, complete kills were obtained with formulations of 1½ to 3 pounds of malathion and 1 gallon of light summer oil in 100 gallons of water. Spray formulations of 1½ to 3 pints of 25-percent liquid emulsifiable guthion for each 100 gallons of water have given equally effective results. Sprays of this type should be timed to coincide with the 2-week period when crawlers are active and before they settle and become covered with scales. The proper time to spray can best be determined by frequent sampling of the populations. Sprays should be applied with high pressure equipment to the point of runoff.

Caution: Malathion and guthion are toxic compounds; indiscriminate use can endanger people, domestic animals, wildlife, and fish directly and by contaminating water supplies. Malathion is much the milder of the two, but precautions must be taken in mixing and applying either material. Read the label on the container. Wear protective clothing. Avoid spilling, contact with the skin, or excessive inhalation. Wash exposed skin with soap and water. Always mix and apply formulations in the open.

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